Utilization of Enzyme Supplemented Wheat offal-rice bran based diets on performance characteristics and serum biochemistry by meat-type chicken

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Abstract

An experiment was conducted to investigate the effect of exogenous enzyme supplementation on the utilization of rice bran as a replacement for wheat offal by meat-type chicken. A total of three hundred and twenty day-old Marshal[®] strain broiler chickens were randomly allocated to eight dietary treatments. Each dietary treatment had 40 birds with 10 birds in each replicate. The wheat offal in diets was replaced by rice bran (RB) at four levels (0%, 10%, 20 % and 30%). Each diet contained 2853.10, 2837.90, 2822.70, and 2807.50 ME Kcal/kg and Crude Protein% of 21.68, 21.57, 21.47 and 21.36. The diets were in two groups. One group was supplemented with exogenous enzyme while the other group was not supplemented with enzyme. The growth performance, serum biochemistry and organ weight were estimated. Data obtained were subjected to Analysis of variance in a 2 × 4 factorial arrangement. Results showed that the final body weight gain was significantly higher ($P < 0.05$) at 20% rice bran inclusion level while the feed conversion ratio was lower ($P < 0.05$) at this level. Birds fed 30% rice bran inclusion level had significantly lower ($P < 0.05$) value of total protein, Globulin and Serum Glutamate Oxaloacetate Transaminase (SGOT). Birds on diet containing 30% level of rice bran had high total protein, Globulin and SGOT. It was concluded that 30% rice bran with enzyme supplementation had no adverse effect on the performance, serum biochemistry and internal organs of the birds.

Key words: Rice Bran, enzyme supplementation, broilers, utilization, wheat offals, serum biochemistry.

Introduction

Rice bran constitutes about 10% of brown rice and it is used as animal feed resource which

serves as an energy diluent but it contains some antinutritional factors that are common in feedstuffs of plant origin which can disturb

metabolic processes and reduce utilization of nutrients in the animals. Since rice bran is available locally, research on feeding value of rice bran in meat-type chicken is highly beneficial for further development of the poultry industry. The availability of rice bran and its lower price inform its use in poultry feeds but its high fibre content and low metabolizable energy (Scott *et al.*, 1982) limit its use in poultry. Awesu *et al.*, (2002) recommended 30% level of rice mill waste in cockerel finisher diets when the diet is supplemented with palm oil. Also Fabiyi (2008) reported that 30% rice bran in broiler diets replacing maize significantly improved live weight gain and feed conversion efficiency was not affected. Fresh rice bran can be used up to 20% in diet of broiler without any adverse effects on performance, mortality and organ weight (Mujahid *et al.*, 2004). It was suggested that increasing levels of rice bran above 20% in broiler diets have significantly negative effects on broiler performance with increase in mortality and organ weight. The nutritional value of rice bran in animal diets may be improved by supplementing it with exogenous enzymes. The use of exogenous enzymes in domestic chicken has become more common in recent years (Lazaro *et al.*, 2003; Mathlouthi *et al.*, 2003; Rafuse *et al.*, 2004). In poultry diets, exogenous enzymes are employed to increase the digestibility of feed ingredients and reduce the incidence of wet droppings which may result from the presence of non-starch polysaccharides (NSPs) (Choct *et al.*, 1995; Acamovic, 2001). This study was designed therefore to look into the effect of enzymes

supplementation on the utilization of rice bran in the diets by meat-type chicken.

Materials and methods

Location of Experiment

This research work was carried out at the Poultry Unit of the Teaching and Research Farm of the University of Agriculture, Abeokuta, Ogun State, Nigeria.

Source of test ingredient

The rice bran, a by-product of rice milling activities for human consumption, was obtained from a commercial rice milling factory at Lafenwa, Abeokuta in Ogun State.

Experimental diets

A standard broiler diet was formulated with wheat offal. In the other diets, rice bran (RB) was used to replace wheat offal at 10, 20 and 30% levels. The diets were in two groups, one group was without enzyme supplementation while the other group was supplemented with multi-enzyme mixture, making a total of eight diets. Ingredient and proximate composition of the diets are shown in table 1

Description of enzyme used

Rovabio™ Excel AP is a concentrated powder whose main enzymatic activities are xylanase and β -glucanase obtained from a fermentation broth of *Penicillium funiculosum*. This product hydrolyzes pentosans and β glucans in plant raw materials. The main active substances include Endo-1,4- β -xylanase N EC 3.2.1.8, Endo-1,3 (4)-B-glucanase; N EC 3.2.1.6, other enzyme activities; cellulases Minimum activities

Table 1: Gross Composition of Experimental Diets Broilers (0-8 weeks) (g kg⁻¹)

INGREDIENTS	Without Enzymes			With Enzymes				
	Levels of Rice Bran			Levels of Rice Bran				
	0%	10%	20%	30%	0%	10%	20%	30%
Maize	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
Soyabean meal	232.0	232.0	232.0	232.0	232.0	232.0	232.0	232.0
Fish meal	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Groundnut cake	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0
Wheat offal	100.0	90.0	80.0	70.0	-	90.0	80.0	70.0
Rice Bran	-	10.0	20.0	30.0	100	10.0	20.0	30.0
Bone Meal	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Oyster Shell	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Lysine	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Methionine	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Premix	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Enzyme	-	-	-	-	+	+	+	+
Salt	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Total	1000	1000	1000	1000	1000	1000	1000	1000
DETERMINED ANALYSIS								
ME/Kcal/Kg	2853.10	2837.90	2822.70	2807.50	2853.10	2837.90	2822.70	2807.50
Crude Protein%	21.68	21.57	21.47	21.36	21.68	21.57	21.47	21.36
Ether extract	3.49	3.54	3.58	3.63	3.49	3.54	3.58	3.63
Crude fibre	2.80	3.22	3.64	4.06	2.80	3.22	3.64	4.06
Calcium%	1.47	1.48	1.48	1.49	1.47	1.48	1.48	1.49
Phosphorus%	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Lysine	1.52	1.51	1.50	1.50	1.52	1.51	1.50	1.50
Methionine	0.52	0.53	0.53	0.53	0.52	0.53	0.53	0.53

*Level of enzyme inclusion at 100ppm

include; Endo-1,4- β xylanase N EC 3.2.1.8 to be 22 000 units visco/g (equivalent to 1400 units AxClg) and Endo-1-3(4)-B-glucanase N EC 3.2.1.6 to be 2 000 AGL units/g.

Experimental Animals and protocols

A total 320 day-old chick was randomly allocated to treatment groups with 40 birds per treatment and four replications consisting ten (10) birds. Feed and water were provided *ad libitum*. Vaccination and medication programme for broiler chickens were also adhered to. Routine and occasional management practices were carried out as and when due while litters were changed regularly to prevent build up of

pathogens and disease outbreak during the course of the study. The experiment lasted for eight weeks. Measurements taken include weight gain, feed intake, feed to gain ratio, some serum biochemistry profile as well as weight of some organs.

Blood serum analysis

At day 56 of the study, blood samples were collected from the birds through neck slitting. 2.5ml of blood was collected from 2 birds per replicate into hypodermic syringe for the determination of serum parameters (Serum total protein, Albumin, Globulin, Urea and Creatinine). The Serum total protein, Albumin

Table 2: Effect of rice bran and enzyme inclusion on the performance characteristics, serum profile and organ weight of broilers in a wheat offal-rice bran based diet.

PARAMETERS	Levels of wheat offal to Rice Bran				ENZYME			
	(100:0)	(90:10)	(80:20)	(70:30)	SEM	-	+	SEM
Performance								
Initial body weight (g/bird)	44.90	45.04	45.19	44.77	0.172	45.03	44.93	0.12
Final body weight (g/bird)	1643.50 ^d	1707.94 ^c	1800.56 ^b	1813.45 ^a	35.47	1747.95	1734.78	25.08
Body weight gain (g/bird)	28.65 ^c	29.70 ^b	31.35 ^a	31.58 ^a	0.62	30.46	30.18	0.44
Feed intake (g/bird/day)	102.73 ^b	102.32 ^b	94.94 ^c	107.40 ^a	3.31	97.35	106.35	2.215
FER	0.28 ^c	0.29 ^b	0.33 ^a	0.30 ^a	0.008	0.32 ^a	0.28 ^b	0.01
FCR	3.62 ^a	3.45 ^b	3.03 ^d	3.40 ^c	0.081	3.19 ^b	3.56 ^a	0.06
Serum								
Total Protein(g/l)	43.95 ^c	42.90 ^c	46.70 ^b	47.03 ^a	1.02	44.13 ^a	46.16 ^b	1.01
Albumin(g/l)	24.58	23.68	23.43	24.38	0.27	24.26	23.76	0.25
Globulin(g/l)	19.38	23.03	19.48	22.68	0.99	21.91	20.36	0.77
SGOT(mg/dl)	104.23 ^a	106.65 ^b	94.20 ^c	91.85 ^d	0.11	103.91	94.55	4.68
SGPT(mg/dl)	16.13 ^a	15.23 ^b	14.18 ^c	12.15 ^d	0.86	16.49 ^a	12.35 ^b	2.07
Uric Acid(mg/dl)	5.15 ^a	4.28 ^b	4.03 ^c	3.58 ^d	0.35	4.84 ^a	3.63 ^b	0.58
Creatinine(mg/dl)	1.03 ^a	1.03 ^a	0.98 ^b	0.95 ^b	0.02	1.03 ^a	0.94 ^b	0.05
Organs Weight (%)								
Gizzard	3.30 ^d	3.40 ^c	3.56 ^b	4.08 ^a	0.27	3.50	3.59	0.15
Liver	2.49 ^a	2.07 ^b	0.81 ^d	1.92 ^c	0.25	2.09 ^a	1.99 ^b	0.16
Abdominal fat	1.05 ^c	1.10 ^b	1.02 ^c	1.26 ^a	0.06	0.96 ^b	1.26 ^a	0.27
Intestine	7.79 ^a	6.40 ^b	5.76 ^c	5.72 ^c	0.15	6.48 ^a	6.16 ^b	0.28
Kidney	0.67 ^a	0.43 ^d	0.66 ^b	0.51 ^c	0.16	0.59	0.54	0.11

^{abcd} Means on the same row having different superscript were significantly different ($P < 0.05$)

and Globulin were analysed colorimetrically using diagnostic reagent kit (Varley *et al.*, 1980)

Organs measurement

At the end of the feeding trial, four birds from each replicate were selected based on average weight of the group for organs assessment. The killing of the birds was preceded by starving the animals of feed and water for 24 hours. The birds were then bled through cervical dislocation. Evisceration was then done. The organs were

carefully removed and weighed and weight was expressed as percentage of the live weight.

Statistical Analysis

The experiment was a 2x4 factorial arrangement within a randomized complete block design. All the data generated were subjected to Analysis of Variance using SAS Statistical Package (SAS, 1999). Significant differences among means were separated using Duncan Multiple Range Test (Duncan, 1955).

Results and Discussion

Statistical analysis of data on final body weight showed significant differences among the treatment groups due to dietary inclusion of rice bran (Table 2). This is in agreement with the report of Mujahid *et al.* (2004) who reported that 30% of stored rice bran has no adverse effects on broiler performance. The value for the final body weight per bird was higher at 30% rice bran (RB) inclusion diets. The final body weight per bird increased as the level of rice bran inclusion increased. The body weight gain per day increased significantly due to RB inclusion. The results obtained in this study is contrary to that of Deaton *et al.* (1981), Fan *et al.* (1995) and Purushothaman *et al.* (2005). These workers reported that the body weight of broilers fed with different levels of crude rice bran oil did not differ significantly when compared to control. However, in this experiment the broilers fed with 20% and 30% rice bran showed significantly higher body weight gain. This suggests that there was a correlation between final body weight and body weight gain. Feed intake per bird per day was significantly higher at 30% rice bran inclusion diets. This confirms the report of Gibson *et al.* (1990) who reported that there is direct correlation between feed intake and weight gain. The feed intake per bird per day was not significantly different among the groups treatment mean. This results however, contradicted the report of Ibiyo and Atteh, (2005) that feed intake reduced with increase in dietary level of rice bran in the absence of palm oil. The feed efficiency ratio was significantly better at higher levels of RB. The result suggests that inclusion of RB in the diets can be utilized in

broiler diets up to 30% levels of inclusion. The present study showed that the addition of Rovabio enzyme supplementation to wheat offal-rice bran based diets has no significant difference ($P>0.05$) on final body weight, body weight and feed intake. The result was contrary to the report of Classen *et al.* (2003) who reported that supplementation of corn based diets with amylase enzyme improved growth response and nutrient digestibility of broilers. Enzymes supplementation of wheat offal-rice bran diet did not result in decreased feed efficiency ratio. However, previous results of F.Gao *et al.* (2007), Janssen *et al.* (1990) support the present results that the addition of enzyme supplementation to wheat offal -Rice bran diets significantly increased feed conversion ratio ($P<0.05$). The result suggests that addition of RB to the diets may not be necessary at the present levels of inclusion.

There was no significant effect ($P>0.05$) of rice bran inclusion levels on albumin and globulin (Table 2). However, the levels of rice bran included in the diets significantly ($P<0.05$) influenced levels of total protein, SGOT, SGPT, uric acid and creatinine. Serum total protein had the highest value in the birds that were offered 30% rice bran inclusion level. This high total protein is an indicator of sufficient protein intake (Wilson and Brigstocke, 1981). The SGOT and SGPT values reduced as the levels of rice bran inclusion increased. With insufficient energy, transaminase enzyme promotes the removal of the amino acid group of the amino acids to yield corresponding acids, which enters tricarboxylic acid cycle for additional energy generation (Adeniji and Ogunmodede, 2006), hence this

observation may have been responsible for improved protein intake. Uric acid values were highest at 0% rice bran inclusion level which indicates the poor protein utilization by the birds in that group. Enzyme supplementation significantly ($P < 0.05$) affect total protein, SGOT, SGPT and Creatinine. Broilers fed diets supplemented with enzyme on supplemented diet had significantly higher total protein. The lower values of SGOT and creatinine in the groups with enzyme supplemented may be due to the fact that enzyme addition to the rice bran based diets help the birds to better hydrolyze the feed. Enzyme mixture has been reported to reduce antinutritive effect by reducing digesta viscosity (Choct and Annison, 1992 and Smith *et al.*, 1997) and increasing fermentation in the small intestine with subsequent decrease in nutrient digestion (Choct *et al.*, 1995). However, the increased concentration of TP and SGPT can be attributed to the fact that there was sufficient intake of protein in broiler chicken which leads to high protein utilization by the broilers.

The result of the organ weights is presented in table 2. Gizzard weight was significantly ($P < 0.05$) influenced by the levels of RB in the diets. Birds on 30% RB had higher gizzard weight. The value reduced significantly across the treatments. This observation might not be unconnected with the plane of nutrition. Since gizzard is a major organ responsible for grinding of feed stuffs eaten by birds, the experimental birds on 30% RB had higher gizzard weight probably because the birds were trying to cope with elevated crude fibre of the resultant diet due to RB inclusion. No specific pattern was recorded for liver weight of the experimental birds, but

birds on the control diet recorded significantly ($P < 0.05$) higher value. This observation is also in line with elevated values of serum liver enzymes. Higher levels up to 30% RB in the diet encourage fat laid down in the experimental birds. The elevated abdominal fat may have to do with increased feed intake and not necessarily related to increased ether extract in the feed offered. The weight of the intestine reduced as the level of RB increased in the diets. This observation may be related with the rate of movement of feed materials in the gastrointestinal tract.

Conclusion

The study demonstrated that broilers meant to be sacrificed at eight weeks can be offered RB in addition with wheat offal up to 30% inclusion rate. The addition of enzyme though conferred certain beneficial influence, its effectiveness at higher levels of RB should be explored. Therefore, the use of RB in broiler diets up to 30% levels does not have negative effect on performance, serum biochemistry and organ weight.

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(Received 20th July, 2009; Accepted 29th January, 2010)